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⑰ Applicant: **FMC CORPORATION**  
**200 East Randolph Drive**  
**Chicago Illinois 60601(US)**

⑱ Inventor: **Fishman, Udi**  
**3419 Ruby Court**  
**San Jose, California 95148(US)**

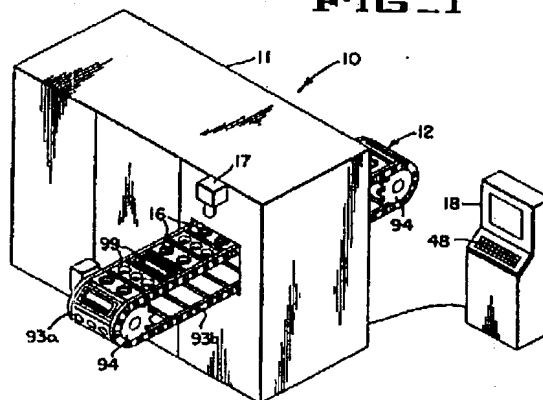
⑲ Representative: **Altenburg, Udo, Dipl.-Phys. et al**  
**Patent- und Rechtsanwälte**  
**Bardehle-Pagenberg-Dost-Altenburg**  
**Frohwitter-Gelssler & Partner Postfach 86 06**  
**20**  
**W-8000 München 80(DE)**

① Plastic welding apparatus.

① A plastic welding apparatus (10) for sealing a first plastic material to a second plastic material. The apparatus (10) uses a laser beam to weld a plastic cover material to a wide variety of shapes and sizes of containers (16). An optical scanner (17) detects the location of a zone of overlapping material and provides signals to a computer (18) which directs a

laser beam through a laser semi-transparent material to a laser-opaque material in the sealing zone. The opaque material converts the laser beam into heat and melts the material to fuse the two materials together. A conveyor (12) or other means, such as a robot can be used to move the containers (16) into position for the welding operation.

**FIG. 1**



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## BACKGROUND OF THE INVENTION

The present invention relates to a plastic welding apparatus, and more particularly, to a laser apparatus for welding a first pre-cut or roll stock plastic to a second plastic and for trimming the plastics to a desired shape.

Plastic containers are commonly used for the packaging of food and for a wide variety of other items wherein a pouch is formed by folding a flat piece of plastic membrane into a general form of a bag, and one edge portion of the membrane is sealed to another edge portion by the use of heat. In another application, a semi-rigid plastic container is filled with a product and a plastic lid is bonded to the container by the application of heat. The required heat can be provided by an electric hot plate which partially melts portions of the lid and container so the lid fuses to the container. When the hot plate is mounted adjacent to the lid heat, must be transferred by convection and conduction through the lid to the junction between the lid and the container in order to melt portions of the container which fuses to the lid. As a result the operation is relatively slow.

Another method of bonding involves the use of laminated plastic lids which have a layer of metal foil. An oscillating magnetic field induces an electrical current into the metal foil to develop heat which melts portions of the lid and container and fuses the lid to a lip of the container. An induction coil having an electrical current directs the oscillating magnetic field to an area adjacent to the junction of the lid and container lip. The oscillating magnetic field is not readily adaptable for sealing a plastic lid to containers with partitions, such as TV dinner trays.

## SUMMARY OF THE INVENTION

The present invention discloses a plastic welding apparatus which uses a single laser beam to weld a first piece of plastic to a second piece of plastic. When preformed plastic containers are used the welding apparatus seals plastic lids or other cover material to a plurality of different shapes of containers and trims off any excess material from the lid. The laser beam can also be used to imprint labels or other information on the surface of the lid or container and to provide holes or perforations in untrimmed portions of the lids. The lids are made of a layer of material which is transparent to a laser beam and a layer of material which is laser-opaque. A laser beam passes through the transparent material with little energy loss and is absorbed by the laser-opaque material where the beam is converted to heat. The heat from this opaque material melts the adjacent bond-

ing layers so these layers fuse with a bonding layer of the container. The laser-opaque material can also be incorporated in the bonding layers. Energy is applied to a very localized area to provide rapid sealing and to minimize damage to other layers of either the lid or the container or to food inside the container.

A moving means can be used to transport containers past a scanner which collect information about the size, shape, orientation and location of each of the containers on the moving means and feeds this information to a computer. A sensor on the moving means feeds information about the velocity of container travel to the computer. The computer uses the size, shape, location, orientation and velocity information to direct the laser beam to seal lids to containers, and to trim and label lids and containers when needed. The laser beam can be precisely focused to apply heat only to desired areas of the lids and containers. The laser beam can be readily directed to seal the lids to partitions in containers, and to seal lids to odd shaped containers with relative ease of change over. The computer can use the size and shape information for automatically adjusting the laser beam path for sealing lids to containers or a manual set up can be used.

## BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is an isometric of a plastic welding apparatus of the present invention showing a means for moving containers through the sealing system.

Figure 2 is a schematic of the laser beam and beam control system.

Figure 3 is an isometric of another embodiment of the laser beam and means of directing the beam.

Figure 4 is another embodiment of the apparatus of Figure 1.

Figure 5 is a cross section of a thin foil lid and a container having a plurality of compartments.

Figure 6 is a cross section of a simple container having an attached thick form lid.

Figure 7 is an enlarged cross section of a portion of Figure 6.

Figure 8 is a front view of the plastic welding apparatus of Figure 1 showing details of the physical layout of the apparatus.

Figure 9 illustrates an embodiment of the present invention for sealing a plastic lid to a plastic container.

Figure 10 is an enlargement of a portion of Figure 9.

Figure 11 is a top view of a 6-pack of plastic containers having a common lid.